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(54) [Name of the invention]

Manufacturing Method for the Preparation of Embossing Pattern Possessing Surface Type Thermoplastic Resin and the Equipment Used

(57) [Summary]

[Goal]

The goal of the present invention is to suggest a manufacturing method and equipment for the preparation of an embossing pattern possessing surface type thermoplastic resin material, where it is possible to increase the manufacturing properties and also it is possible to practically decrease the manufacturing costs.

[Structure]

The thermoplastic resin sheet 11 is pushed by the elastic roll 16 on the outer surface of the first transport roll 13 of the endless belt 15, and by that it is placed on the endless belt 15. The sheet 11 that is placed on the endless belt 15, is heated at a temperature that is at or above the softening temperature of the sheet 11, and it is rotated between the first and the second transport rolls 13 and 14, and together with that it is transferred to the troll 17 that is used for the formation of the embossing pattern, and the embossing process is conducted is by the tension of the belt 15 that has a wrap angle θ of 5 degrees or more relative to the roll 17. At this time, the embossing technological pross is aided by the pushing from the pressure roll 18.

[Range of the claims of the invention]

[Claim 1]

Manufacturing method for the preparation of an embossing pattern possessing surface type thermoplastic resin material, characterized by the fact that the surface type thermoplastic resin that is placed on the belt and that is heated at a temperature at or above its softening point is transferred onto the roll that is used for the formation of the embossing pattern, and after that, the emboss pattern is formed on the above described surface type thermoplastic resin material as it is contacted with the above described roll at a wrap angle of at least 5 degrees or more with the outer surface of this roll, and after that, the surface type thermoplastic resin material that has the above described embossing pattern formed on it, is cooled.

[Claim 2]

Manufacturing method for the preparation of an embossing pattern possessing surface type thermoplastic resin material according to the above described Claim 1 of the present invention, characterized by the fact that the pressure that is applied at the time of the formation of the embossing pattern on the above described surface type thermoplastic resin material, is at least a surface pressure of 4.9 N/cm, or higher.

[Claim 3]

Manufacturing method for the preparation of an embossing pattern possessing surface type thermoplastic resin material according to the above described Claim 1 and Claim 2 of the present invention, characterized by the fact that the temperature of the roll that is used for the formation of the above described embossing roll at the time of the formation of the embossing pattern on the above described surface type thermoplastic resin material, is lower than the temperature of the above described belt.

[Claim 4]

Manufacturing equipment for the preparation of an embossing pattern possessing surface type thermoplastic resin material, characterized by the fact that it is comprised of a feeding roll that supplies the surface type thermoplastic resin an endless belt that is wrapped around the first and the second transport rolls, and on which the above described surface type thermoplastic resin material is placed, heating means in order to heat the above described surface type thermoplastic resin material, a roll used for the formation of the embossing pattern that is positioned so that the wrap angle that is formed relative to the endless belt in between the above described first and second transport rolls, is at least 5 degrees or more, a pressure roll that applies pressure on the above described surface type thermoplastic resin material from the back surface side of the above described endless belt on the

above described roll that is used for the formation of the embossing pattern, and a cooling means for cooling of the above described surface type thermoplastic resin material with the formed on it embossed pattern.

[Claim 5]

Manufacturing equipment for the preparation of an embossing pattern possessing surface type thermoplastic resin material, according to the above described Claim 4 of the present invention, characterized by the fact that it is provided with an elastic type roll with an attached elastic part material, that is densely adhered onto the above described first transport roll of the above described surface type thermoplastic resin material.

[Detailed explanation of the invention]

[0001]

[Technological sphere of application]

The present invention is an invention about a manufacturing method for the preparation of a surface type thermoplastic resin material that has an embossed pattern, and it is an invention about the equipment used in it. And for example, it can be advantageously used for the preparation of recurrent reflective sheets.

[0002]

[Background technology and problems solved by the present invention]

Regarding the recurrent reflective sheet where on the surface of a thermoplastic type resin sheet a process is conducted whereby microprisms are formed (reflective plate manufactured from plastics) it is used in the sphere of reflective plates, in the sphere of the fashion industry, in the construction field, etc..

As such recurrent reflective sheet, in the United States, the glass beads material and the cube cone type material (cubical cone), have been observed. Usually, the glass beads material has excellent short distance visibility properties, and the cube cone type material has excellent long distance visibility properties and excellent brightness properties because of the light reflection.

[0003]

Regarding the manufacturing of the above described cube cone type recurrent reflective sheet material, it is necessary that the embossing pattern that is used

for the formation of the embossed pattern on the thermoplastic resin sheet material, is correctly transferred. And in order to do that, especially, on the form that is used for the formation of the embossed pattern on the thermoplastic resin sheet material, an appropriate pressure is applied. And not only that, but also, it becomes important that these pressure conditions are maintained for the desired specified amount of time.

[0004]

In the past, as the manufacturing method for the preparation of recurrent reflective sheet by following these important essential conditions, for example, the continuous press method and the belt method, have been suggested. Regarding the above described continuous press method, it is a method where by using press device that has heating and cooling capabilities a a form that is used for the formation of the embossing pattern is sequentially pushed relative to the sheet type material that is continuously placed on the press, and the shape is transferred onto the sheet (examined Japanese Patent Number Showa 60-56103).

[0005]

Regarding the above described belt method, it is a manufacturing method where the shape is transferred onto the sheet by pressing of the belt that has the shape of the embossing pattern and the thermoplastic resin sheet material to each other between a pair of rolls (examined Japanese patent Number Showa 5-17023). However, according to the above described continuous press method, the manufacturing speed is slow, and also, the equipment becomes complex and large size. Also, according to the above described belt method, because the belt itself is the material that has the embossing pattern, there are problems generated regarding the durability properties of the belt that is used as the shape material.

[0006]

Then, regarding the present invention, it is an invention that has as a goal to suggest a manufacturing method and equipment for the preparation of surface type thermoplastic resin material that has an embossed pattern, whereby it is possible to improve the manufacturing properties and it is also practically possible to decrease the manufacturing costs.

[0007]

[Measures in order to solve the above described problems and effect]

Regarding the manufacturing method for the preparation of an embossing pattern possessing surface type thermoplastic resin material, according to the

first claim of the present invention, it is characterized by the fact that the surface type thermoplastic resin that is placed on the belt and that is heated at a temperature at or above its softening point is transferred onto the roll that is used for the formation of the embossing pattern, and after that, the emboss pattern is formed on the above described surface type thermoplastic resin material as it is contacted with the above described roll at a wrap angle of at least 5 degrees or more with the outer surface of this roll, and after that, the surface type thermoplastic resin material that has the above described embossing pattern formed on it, is cooled.

[0008]

As the above described thermoplastic type resin material, it is possible to use any of the polyethylene, polypropylene, polyvinyl chloride, polystyrene, polycarbonate, polymethyl methacrylate etc., however, the materials are preferred that have a low degree of inner part haze (hazing degree). As the above described thermoplastic resin material, it includes both sheets with a relatively thick thickness and films with relatively thin thickness, and the thickness can be freely selected. Also, it is a good option if it is a material that has a multilayer structure that is formed from different types of resins, or materials with a composite structure obtained from materials other than resin type materials.

[0009]

Regarding the detailed shapes of the above described embossing pattern, they can be any types of shapes, for example, if it is a material that is used as a recurrent reflective type of sheet, the pattern is made to be a triangular cone cut pattern (cube cone pattern). Regarding the size of the elements that are ordered in continuous rows that form the structure of the pattern, it can be freely selected, and it is a good option if it is related to the shape.

[0010]

Regarding the above described wrap angle, it is the angle from both edges of the surface type thermoplastic resin material that is in contact with the roll that is used for the formation of the embossed pattern, to the center of this roll. In the case when the above described wrap angle is smaller than the value of 5 degrees or more, reproducibility properties of the prism shape, are deteriorated. Moreover, in more details regarding the wrap angle, it varies depending on the treatment speed, the diameter of the above described roll, the sheet material etc..

[0011]

Regarding the manufacturing method for the preparation of an embossing pattern possessing surface type thermoplastic resin material according to the Claim 2 of the present invention, it is characterized by the fact that it is as in the above described Claim 1 of the present invention, and the pressure that is applied at the time of the formation of the embossing pattern on the above described surface type thermoplastic resin material, is at least a surface pressure of 4.9 N/cm, or higher. In the case when the above described surface pressure is less than 4.9 N/cm², the reproducibility properties of the embossing pattern shape, are deteriorated. Moreover, regarding the upper limit, it is preferred that it is at 1960 N/cm². In the case when the surface pressure is larger than 1960 N/cm², the belt durability properties are decreased. Also, the scale of the size of the manufacturing equipment is increased and also the manufacturing costs are increased.

[0012]

Regarding the manufacturing method for the preparation of an embossing pattern possessing surface type thermoplastic resin material according to the Claim 3 of the present invention, it is according to the above described Claim 1 and Claim 2 of the present invention, characterized by the fact that the temperature of the roll that is used for the formation of the above described embossing roll at the time of the formation of the embossing pattern on the above described surface type thermoplastic resin material, is lower than the temperature of the above described belt. In the case when the temperature is higher than the above described belt temperature, the reproducibility properties of the embossing pattern shape, are deteriorated. And also, directly after the formation of the embossed pattern, there is also the danger of adhesion of the surface type thermoplastic resin material on the roll that is used for the formation of the embossing pattern. The temperature of the above described roll that is used for the formation of the embossing pattern is for example made to be at or lower than 80°C.

[0013]

Regarding the manufacturing equipment for the preparation of an embossing pattern possessing surface type thermoplastic resin material, according to Claim 4 of the present invention, it is characterized by the fact that it is comprised of a feeding roll that supplies the surface type thermoplastic resin an endless belt that is wrapped around the first and the second transport rolls, and on which the above described surface type thermoplastic resin material is placed, heating means in order to heat the above described surface type thermoplastic resin material, a roll used for the formation of the embossing pattern that is positioned so that the wrap angle that is formed relative to the endless belt in between the above described first and second transport rolls, is at least 5 degrees or more, a pressure roll that applies pressure on the above described surface type thermoplastic resin material from the back surface side

of the above described endless belt on the above described roll that is used for the formation of the embossing pattern, and a cooling means for cooling of the above described surface type thermoplastic resin material with the formed on it embossed pattern.

[0014]

Regarding the heating means for the heating of the above described thermoplastic type resin material, any type of heating means can be used, and for example, it is possible to use as heating means an internal type heating method heating device, that is provided on the above described feeding roll. Regarding the cooling device that is used for the cooling of the above described surface type thermoplastic resin material with the formed on it embossed pattern, for example it is also possible to use a device that is provided in the inner parts of the second transport roll.

[0015]

Regarding the above described endless belt, it is a good option if it is manufactured from metal, and especially from stainless steel. Regarding the thickness of the belt, for example it is made to be in the range of 0.3 ~ 1.5 mm, however, it is preferred to be in the range of 0.5 ~ 0.8 mm. Although it depends on the material, in the case when the belt thickness is less than 0.3 mm, the belt strength becomes weak and the durability properties become poor. On the contrary, if the belt is thicker than 1.5 mm, in order to support the belt it is necessary that the diameter of the roll is made large, and the scale of the size of the equipment becomes large. Also, the heating and cooling efficiencies become poor and the manufacturing costs are increased. Regarding this endless belt, it is preferred that its surface roughness is a mirror surface type of 3S or lower, and more preferably it is at 1S or lower. If it is larger than 3 S, the light is diffused and reflected at the non-embossed surface of the manufactured surface type thermoplastic resin material, and the brightness is decreased.

[0016]

Regarding the manufacturing equipment for the preparation of an embossing pattern possessing surface type thermoplastic resin material, according to Claim 5 of the present invention, it is according to the above described Claim 4 of the present invention, and it is characterized by the fact that it is provided with an elastic type roll with an attached elastic part material, that is densely adhered onto the above described first transport roll of the above described surface type thermoplastic resin material. As the above described elastic part material, for example, it is preferred to use silicone rubber etc., materials that have thermal resistance properties. By having an elastic part material, it

becomes possible to effectively eliminate the air between the endless belt and the surface type thermoplastic resin material.

[0017]

Regarding the pressure that is applied on the above described surface type thermoplastic resin material from the above described elastic roll at the time when it is intimately adhered onto the first transport roll, it is preferred to be at or above 4.9 N/cm². In the case when the pressure is less than 4.9 N/cm², there is the danger that there might be residual air in the space between the surface type thermoplastic resin material and the endless belt.

[0018]

[Practical Example]

In Figures 1 ~ 5, the manufacturing method and the equipment for the manufacturing of surface type thermoplastic resin material with an embossed pattern, according to the practical implementation examples of the present invention, are explained. First, the manufacturing equipment according to this practical implementation example, is explained.

[0019]

As it is shown according to Figure 1, this manufacturing equipment contains a feeding roll 12 that supplies the surface type thermoplastic resin 11, an endless belt 15, that is wrapped around the first 13 and the second 14 transport rolls, an elastic roll 16 that intimately adheres the thermoplastic resin sheet 11 onto the first transport roll 13, a roll 17, that is used for the formation of the embossing pattern, that is positioned so that one part of its outer surface is in a surface type contact with the endless belt 15 in between the above described first and second transport rolls, 13 and 14, a pressure roll 18 (back roll), that applies pressure on the above described surface type thermoplastic resin material 11.

[0020]

Regarding the above described first transport roll 13, in its inner part the electrical heat heater etc., heating means (not shown in the diagram) is provided in order to heat the thermoplastic resin sheet 11. Regarding the above described elastic roll 16, it is a roll where on its outer surface, the manufactured from silicone rubber, thermal resistant elastic part material 21 is stretched and covered. Regarding the above described endless belt 15, it is manufactured from stainless steel, and its surface is a mirror surface with a 3S or less.

[0021]

regarding the roll 17, that is used for the formation of the above described embossed pattern, it is positioned in a position facing the belt 15 that is stretched between the first and the second transport rolls 13 and 14, and it is in a position where it is pushing against the belt side, and one part of its outer surface is in contact with the surface of the belt 15. Then, regarding the angle Θ (wrap angle) that is formed from both edges of the part that is in contact with the roll 17 used for the formation of the embossed pattern of the thermoplastic resin sheet 11, to the center of this roll 17, it is 5 degrees or higher. Then, according to this wrap angle Θ , the tension from the belt 15 is applied onto the roll 17.

[0022]

As it is shown in Figures 2, 3, in the case of this roll 17, that is used for the formation of the embossed pattern, on its outer surface, the shape 23 is formed that is used in order to form the embossed pattern 22 (illustrated in Figures 4, 5) on the thermoplastic resin sheet material 11. Regarding this shape 23, it is a shape containing protrusions and indentations, that correspond to the triangular cone cut pattern, that is used for the preparation of recurrent reflective sheets. Regarding the above described pressure roll 18, it is positioned so that it pushes from the back surface side of the endless belt 16 against the roll 17 that is used for the formation of an embossed pattern on the thermoplastic resin sheet 11. Regarding the above described cooling device (not shown in the figure) that is used for cooling of the above described thermoplastic resin sheet material 11, it is provided on the inside of the second transport roll 14, for example, it is a water cooling device.

[0023]

After that, The manufacturing method for the preparation of a thermoplastic type resin sheet material according to the present invention, by using this equipment, will be explained. As it is shown in Figure 1, the thermoplastic resin sheet material 11 that is unwound from the feeding roll 12, is placed on the endless belt 15, as it is pushed by the above described elastic roll 16 on the endless belt 15 that is on the outer surface of the above described first transport roll 13. Regarding the pushing pressure of the above described elastic roll 16, it becomes a pressure of 4.9 N/cm², relative to the first transport roll 13. The thermoplastic resin sheet material 11 that is placed on the endless belt 15 is heated by the heating device that is inside the first transport roll 13, to a temperature at or above its softening point.

[0024]

After that, the thermoplastic resin sheet material 11 that is heated at a temperature at or above its softening point, is transferred to the above described roll 17, that is used for the formation of the embossed pattern, together with the rotation of the first and the second transport rolls 13 and 14,, and by the tension force of the belt 15, that occurs at the above described wrap angle Θ , the shape 23 of the roll 17, is transferred onto the sheet 11, and the embossing technological process is conducted. At this time, the embossing technological process is aided by the pushing pressure obtained from the above described pressure roll 18. Regarding the pushing pressure from the this pressure roll 18, the surface pressure becomes 4.9 N/cm² or higher. Moreover, regarding this roll 17 that is used in order to form the embossed pattern, because it is not heated, its temperature becomes lower than that of the endless belt 15 and the sheet 11 that is placed on the above endless belt 15.

[0025]

According to this practical implementation example, at the time of the embossing technological process for the embossing of the thermoplastic resin sheet material 11, the wrap angle of the roll 17 used for the formation of the embossing pattern, to the endless belt 15, becomes 5 degrees or more, and in addition to that, the embossing technological process is aided by the pressure roll 18. And because of that it is possible to transfer the shape 23 of the roll 17, onto the sheet 11 with a good reproducibility. Not only that, but also, the pressure at the time of the conducting of the embossing technological process on the thermoplastic resin sheet material 11, is controlled at 4.9 N/cm² or above, and because of that the reproducibility properties of the embossed pattern shape are good.

[0027]

Also, the thermoplastic resin sheet material 11 is placed on the endless belt 15 as it is pushed by the above described elastic roll 16, and because of that a good intimate adhesion state is achieved between the endless belt 15 and the sheet 11. Especially, the temperature of the above described roll 17 that is used for the formation of the embossed pattern is lower than the temperature of the above described endless belt 15, and because of that it is possible to transfer the shape 23 of the roll 17, onto the sheet 11 with a good reproducibility.

[0028]

[Practical Example 1]

According to the above described practical implementation examples, the manufacturing equipment and the manufacturing conditions are set

according to the described here below, and by that the thermoplastic resin sheet material 11 with an embossed pattern, is manufactured.

[0029]

(1) Manufacturing equipment

diameter of the first transport roll 300 mm
 material of the endless beltstainless steel
 thickness of the endless belt..... 0.5 mm
 width of the endless belt 450 mm
 surface roughness of the endless belt 1S
 diameter of the roll that is used for the formation of the embossed pattern.....250 mm
 embossed patternindented parts triangular cone shape, the length of the side of the triangular opening is 150 microns

diameter of the pressure roll 100 mm
 diameter of the second roll 300 mm

[0030]

(2) Manufacturing conditions

the thermoplastic resin sheet material transparent, soft vinyl chloride sheet (thickness 0.3 mm, width 450 mm)
 temperature of the first roll 120oC
 belt temperature (immediately prior to the roll that is used for the formation of the embossed pattern) 120oC
 sheet temperature (immediately prior to the roll that is used for the formation of the embossed pattern) 120oC
 temperature of the roll that is used for the formation of the embossed pattern 40oC
 wrap angle of the endless belt 30 degrees
 linear pressure of the pressure roll 4.9 N/cm²
 temperature of the second roll 25oC
 treatment speed 2m/min

[0031]

[Practical Example 2]

According to the technological procedures of the above described Practical Example 1, where only the surface pressure of the pressure roll is changed and it is set to be 490.3 N/cm², and everything else is the same as the above

described and by that a thermoplastic resin sheet material that has an embossed pattern, is manufactured.

[0032]

[Practical Example 3]

According to the technological procedures of the above described Practical Example 1, where only the surface pressure of the pressure roll is changed and it is set to be 980.7 N/cm², and everything else is the same as the above described and by that a thermoplastic resin sheet material that has an embossed pattern, is manufactured.

[0033]

[Reference Example 1]

According to the technological procedures of the above described Practical Example 1, except that an equipment is used that is not provided with a pressure roll, and everything else is the same as the above described and by that a thermoplastic resin sheet material that has an embossed pattern, is manufactured.

[0034]

[Reference Example 2]

According to the technological procedures of the above described Practical Example 1, except that an equipment is used that is not provided with an elastic roll, and everything else is the same as the above described and by that a thermoplastic resin sheet material that has an embossed pattern, is manufactured.

[0035]

[Reference Example 3]

According to the technological procedures of the above described Practical Example 1, except that only the temperature of the roll that is used for the formation of the embossed pattern is changed to 130°C, and everything else is the same as the above described and by that a thermoplastic resin sheet material that has an embossed pattern, is manufactured.

[0036]

[Reference Example 4]

An equipment is used that is provided with the roll that is used for the formation of the embossed pattern, that is used according to the Practical Example 1, and a mirror surface treated metal roll (diameter of 250 mm), and in the space between these two rolls, (clearance of 1.5 mm), the thermoplastic resin sheet according to the Practical Example 1 is embossed. Besides that all the other conditions were according to the technological procedures of the Practical Example 1.

[0037]

[Reference Example 5]

According to the technological procedures of the above described Practical Example 1, except that the endless belt wrap angle is 4 degrees, and everything else is the same as the above described and by that a thermoplastic resin sheet material that has an embossed pattern, is manufactured.

[0038]

The light reflection properties of the above described thermoplastic resin sheets 11, obtained according to the above described Practical Examples 1 ~ 3 and Reference Examples 1 ~ 4, that have an air introduction state, and have an embossed pattern reproducibility properties and have an embossed pattern, are evaluated. The results from these evaluations are shown according to Table 1. Regarding the above described air introduction state evaluation, it is conducted as in the space between the thermoplastic sheet 11 and the endless belt 15 or the roll 17, that is used for the formation of the embossed pattern, air is introduced and the caused by that good or poor phenomena are observed. In the evaluation columns, O means that there is no air bleed, x means that there is air introduction.

[0039]

Regarding the evaluation of the reproducibility properties of the above described embossed pattern, it is conducted by the observation of the embossed pattern 22 of the thermoplastic resin sheet material 11, by using a microscope. In the evaluation columns, ◎ has the meaning that over the whole surface of the sample sheet there is a correct reproducibility of the embossed pattern up to the edges of the triangular cone cut pattern, O means that over part of the surface of the sample sheet there is a correct reproducibility of the embossed pattern up to the edges of the triangular cone cut pattern, x means that the embossing pattern is not correctly reproduced. Regarding the light reflective properties of the above described sheet 11, it is conducted as in a dark room, light is shined at a distance of 10 m from the sample sheet, and the brightness is observed by naked eye. In the evaluation

column, O means that the brightness is high, x means that the brightness is low.

[0040]

[Table 1]

【表1】

	2 製造装置	3 ベルト の温度 (℃)	4 加圧ロー ルの面圧 (N/cm ²)	5 エンボス の温度 (℃)	6 エアー の送り 込み	7 エンボ の再現 性	8 シート の光反 射性
実施例1	実施例の装置	120℃	9.8	40	○	◎	○
実施例2	実施例の装置	120℃	490.3	40	○	◎	○
実施例3	実施例の装置	120℃	980.7	40	○	◎	○

Headings in the table:

1. Practical Example, 2. manufacturing equipment, 3. belt temperature, 4. surface pressure of the pressure roll, 5. temperature of the embossing roll, 6. air introduction, 7. reproducibility of the embossing pattern, 8. light reflectivity properties of the sheet, 9. practical implementation example equipment.

[Table 2]

	2 製造装置	3 ベルト の温度 (℃)	4 加圧ロー ルの面圧 (N/cm ²)	5 エンボス の温度 (℃)	6 エアー の送り 込み	7 エンボ の再現 性	8 シート の光反 射性
比較例1	加圧ローなし	120℃	—	40	○	×	×
比較例2	弾性ローなし	120℃	9.8	40	×	○	○
比較例3	実施例の装置	120℃	9.8	130	○	×	×
比較例4	2本のロール	—	9.8	40 (120)	○	×	×
比較例5	抱き角度4度	120℃	9.8	40	○	×	×

1. Reference Examples, 2. manufacturing equipment, 3. belt temperature, 4. surface pressure of the pressure roll, 5. temperature of the embossing roll, 6. air introduction, 7. reproducibility of the embossing pattern, 8. light reflectivity properties of the sheet, 9. without a pressure roll, 10. without an elastic roll, 11. practical implementation example equipment, 12. 2 rolls, 13. wrap angle.

* the (120) in the Reference Example 4, represents the temperature of the non-embossing roll.

[0042]

According to Table 1, in the case of the Practical Examples 1 ~ 3, an embossed pattern possessing thermoplastic resin sheet material 11 is manufactured by using the equipment according to this practical implementation example and under the conditions of the practical implementation example, and because of that it is understood that it is a material that has no problems in any of the areas of the air introduction state, reproducibility of the embossing pattern and the air reflectivity properties of the sheet.

[0043]

On the other hand, according to the Reference Example 1 from Table 2, an equipment is used that is not provided with a pressure roll, and because of that there are problems regarding the reproducibility of the embossing pattern and the light reflectivity properties of the sheet. According to the Reference Example 2, an equipment is used that is not provided with an elastic roll, and because of that, an air introduction is generated.

[0044]

According to the Reference Example 3, the temperature of the roll that is used for the formation of the embossed pattern is 130°C and because of that there are problems regarding the reproducibility properties of the embossed pattern and the light reflection properties of the sheet. According to the Reference Example 4, a 2 roll embossing technological process is employed and because of that there are problems regarding the reproducibility properties of the embossed pattern and the light reflection properties of the sheet. According to the Reference Example 5, the wrap angle is 4 degrees, and because of that there are problems regarding the reproducibility properties of the embossed pattern and the light reflection properties of the sheet.

[0045]

[Results from the present invention]

According to the manufacturing method and manufacturing equipment for the preparation of a surface type thermoplastic sheet material according to the present invention, it is possible to increase the manufacturing properties, and also, it is possible to practically decrease the manufacturing costs.

[Simple explanation of the figures]

[Figure 1]

Figure 1 represents a figure of the schematic diagram of one practical implementation example of the manufacturing equipment according to the present invention.

[Figure 2]

Figure 2 is an enlarged diagram of the roll that is used for the formation of the embossed pattern, according to the same practical implementation example.

[Figure 3]

Figure 3 represents a sectional view diagram of the A- A in Figure 2.

[Figure 4]

Figure 4 represents an enlarged diagram of the embossed pattern possessing thermoplastic resin sheet material, according to the same practical example.

[Figure 5]

Figure 5 represents a sectional view diagram of the B - B in Figure 4.

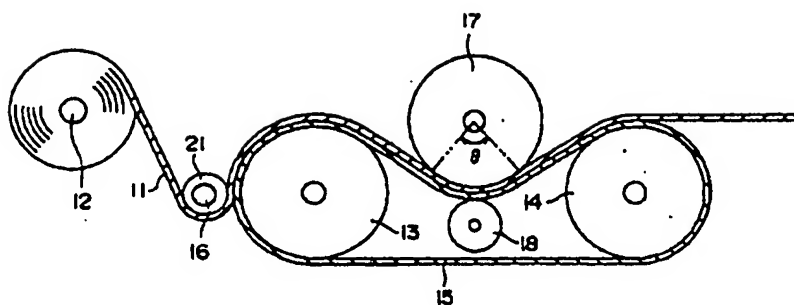
[Explanation of the signs]

- 11.....thermoplastic resin sheet that is made from a surface type thermoplastic resin material
- 13.....first transport roll
- 14.....second transport roll
- 15.....endless belt
- 16.....elastic roll
- 17.....roll used for the formation of an embossing pattern
- 18.....pressure roll
- 21.....thermo-resistant elastic part material
- 22.....embossing pattern
- 23.....shape

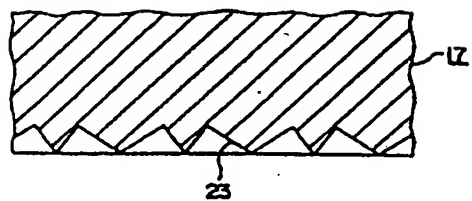
Patent Assignee: Suiko Petrol Company

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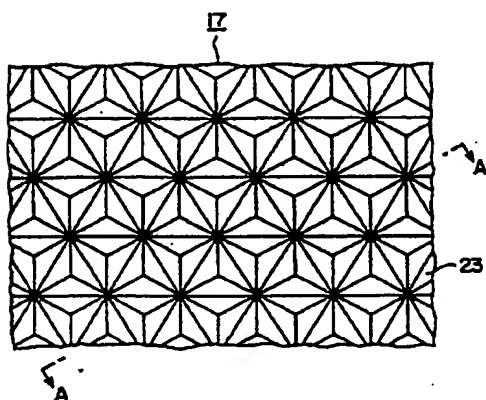
【図1】



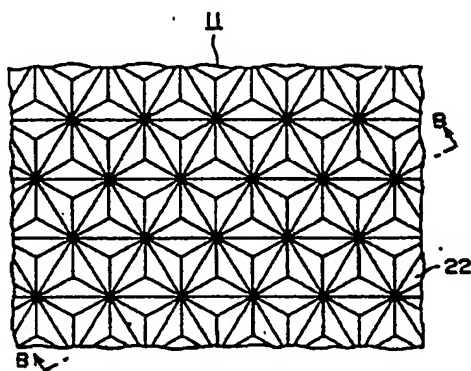
【図3】



【図2】



【図4】



【図5】

